at some satisfactory method for quantitative estimation of vegetational values is of particular interest. The methods of the earlier workers were heterogenous and often confused. Later methods gained in the matter of clarity of ideas, but were highly complicated and exceedingly laborious. Present day effort is toward simplification, and in this the work of RAUNKIAER and BRAUN-BLANQUET is perhaps most promising. The latter's paper, in addition to the effort toward clarification and simplicity, just mentioned, is notable for its proposal to classify his plants also according to their dynamic value, that is, in American terminology their successional value. He proposes a series of five valuations to be applied to the species in any given association, together with symbols for their convenient designation. His class names, with approximate English equivalents, are aufbauend (constructive), erhaltend (maintaining), festigend (consolidating), neutral (neutral), abbauend, zerstörend (disruptive). The idea of progressive and regressive succession is thus clearly postulated.

The ecological implications in FITTING'S contribution are all the more valid in that they are not directly intended. The author is a physiologist, and his primary concern is the avoidance of the artificial and abnormal conditions imposed on his material by the greenhouse methods of ordinary laboratory practice. He contends that the physiology of plants should be studied where the plants naturally occur, and insists on the study of climatic, edaphic, and biotic factors as they affect the space actually occupied by the plant in the field. This, of course, coincides with the activities of the younger American ecologists who are carrying physiology out of doors.

PALMGREN'S study is one of migration, and thus implies the successional viewpoint throughout; it is the more noteworthy in that it was conducted on the Aland archipelago, almost within sight of Uppsala. These islands, he estimates, have not been emerged for more than 3500 years; moreover, they are high-boreal in position, so that an ecologist with the successional viewpoint can extract much aid and comfort from his conclusions.

All this is gratifying to Americans, but as yet there is not much indication of reciprocity on our part. FULLER and BAKKE anticipated the German publication of RAUNKIAER in making his ideas accessible to the English-reading public, but little or nothing has been done in this country with his methods. Probably most American ecologists feel that still further simplification is needed. RAUNKIAER himself admits that his methods involve a good deal of labor. Then there is also the element of time; it generally takes about two graduate "generations" to establish a new idea.—FRANK THONE.

Stomatal regulation.—Using LLOYD'S methods of studying stomata, which he thinks have been criticized without sufficient reason, LOFTFIELD[6] has made

[6] LOFTFIELD, J. V. G., The behavior of stomata. Carnegie Publ. no. 314. pp. 104. 1921.

an extensive study of diurnal stomatal changes, the influence of physical factors on the opening and closing of stomata, and the effects of these stomatal movements on transpiration. The main observations were made on alfalfa, potato, sugar beet, onions, and cereals, but some sixty species in all have been examined. He finds three types of stomatal behavior: the cereal type, typified by barley; the thin-leaved mesophyte type, typified by alfalfa; and the fleshy-leaved type (not confined however to plants with fleshy leaves), typified by such plants as the potato, cow beet, and onion; each of these has a different closure reaction to extreme conditions. The cereals show no opening of stomata at night, no matter how slight the opening by day has been. The thin-leaved mesophytes have the stomata usually open by day and closed at night, but under extreme conditions show a closure during the middle of the day, correlated with an opening at night. The thick-leaved plants behave much as marsh plants do, having their stomata open day and night when water content is high and evaporation low, and showing a tendency to close only when the evaporating capacity of the air is high.

Many details regarding the effects of environmental changes, such as light intensity, temperature, evaporation, wind flow, water content of soil, leaf turgor, and habits of growth on stomatal behavior are presented, from which one may draw the general conclusion that stomata are sensitive to environmental conditions, particularly to light, and to factors that reduce the water content of the leaf, and that they open and close as conditions necessitate. The evaporation studies indicate that atmometers and potometers do not measure accurately the total effect of evaporation factors upon plants, a result that is not surprising.

The final section on the effect of stomatal movement upon transpiration throws much light on the mooted question as to whether stomata exert a regulatory function in transpiration. LLOYD had concluded in 1908 that stomata have no regulatory function, a conclusion which was rendered doubtful by several investigators, including ILJIN, who studied the transpiration of mesophytes and xerophytes in ravines and on the Russian steppes, and who found marked evidences of regulation of transpiration. This work by LOFTFIELD seems to settle the question definitely in favor of stomatal regulation, particularly when the apertures are nearly closed. As long as the apertures are more than 50 per cent open, the transpirational water loss is controlled by evaporation factors alone, but with closure almost complete, the stomata regulate very closely the water loss from the plant. The paper is beautifully illustrated with plates showing photomicrographs of stomata.—C. A. SHULL.

Anthocyan pigments.—NOACK[7] has found rhamnose-free flavonol diglucosides to be much more abundant in green leaves than has generally been supposed. In such leaves as he studied he was able to establish the existence

[7] NOACK, K., Zeitschr. Botanik 14:1–74. 1922.